"Seeking Signs of Life"
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Speaker and Moderator Biographies

Steven A. Benner is founder and Distinguished Fellow of the Foundation for Applied Molecular Evolution (FfAME) in Gainesville, Florida, and a Principal Investigator with the NASA Exobiology and Evolutionary Biology program: his current project is entitled, "Prebiotic routes to carbohydrates involving borate minerals." He is the author of *Life, the Universe, and the Scientific Method* (2009). He is also the leader of a FfAME team that is competing for the $10 million Archon Genomics X PRIZE, offered to "the first team that can build a device and use it to sequence 100 human genomes within 10 days or less, with an accuracy of no more than one error in every 100,000 bases sequenced, with sequences accurately covering at least 98% of the genome, and at a recurring cost of no more than $10,000 per genome." Dr. Benner has B.S. and M.S. degrees in Molecular Biophysics and Biochemistry from *Yale University* (1976) and a Ph.D. in Chemistry from *Harvard University* (1979). Dr. Benner's research group initiated synthetic biology as a field. It was first to synthesize a gene for an enzyme and used organic synthesis to prepare the first artificial genetic systems. His group also invented dynamic combinatorial chemistry, combining ideas from molecular evolution, enzymology, analytical chemistry, and organic chemistry to generate a strategy to discover small molecule therapeutic leads; established paleomolecular biology, where researchers resurrect ancestral proteins from extinct organisms for study in the laboratory; and helped found evolutionary bioinformatics.

Constance (Connie) Bertka received her Ph.D. in geology from Arizona State University. Dr. Bertka was a Senior Research Associate at the Geophysical Laboratory of the Carnegie Institution of Washington from 1993 to 2000. Much of her work at the Geophysical Laboratory focused on modeling the interior structure and composition of Mars utilizing data from high-pressure laboratory experiments. She also directed Carnegie's Broad Branch campus intern program. In addition to her scientific work, Dr. Bertka has had a long-term interest in the relationships between science and religion and their influence on public understanding of science. She also holds a Master of Theological Studies degree from Wesley Theological Seminary in Washington DC. In 2000 she joined the Program of Dialogue on Science, Ethics, and Religion (DoSER) of the American Association for the Advancement of Science (AAAS). For six years she served as the Program's Director. While at AAAS, Dr. Bertka initiated projects that encouraged constructive interaction between the scientific community, religious communities and society at large on a diverse range of topics including astrobiology, evolution, and science education. Currently Connie is the Program Director of the Deep Carbon Observatory at the Geophysical Laboratory of the Carnegie Institution of Washington. She also teaches on Contemporary Issues in Science and Religion at Wesley Theological Seminary and is the editor of *Exploring the Origin, Extent, and Future of Life*: *Philosophical, Ethical, and Theological Perspectives*, (Cambridge University Press, 2009).

Linda Billings is a research professor at the George Washington University School of Media and Public Affairs in Washington, D.C. Dr. Billings does communication research for NASA's astrobiology program in the Science Mission Directorate. She also advises NASA's Program Scientist for Mars Exploration and Planetary Protection Officer on communications. Dr. Billings has worked for more than 30 years in Washington, D.C., as a researcher; journalist; writer; policy analyst; communication planner, manager, and analyst; and consultant to the government. She was the first senior editor for space at *Air & Space/Smithsonian* magazine (1986-88), founding editor of *Space Business News* (1983-85), and contributing author for *First Contact: The Search for Extraterrestrial Intelligence* (1990). Dr. Billings was a member of the staff for the National Commission on Space (1985-86), appointed by President Reagan to develop a long-term plan for space exploration. She is a member of Women in Aerospace (WIA) and served as an officer of WIA for 15 years, most recently as president (2003). She is the recipient of a WIA Lifetime Achievement Award (2009) and a WIA Outstanding Achievement Award (1991). She was elected a Fellow of the American Association for the Advancement of Science in 2009, and she serves as a member of the Board of Directors of the American Astronautical Society.

Baruch S. Blumberg is a research physician at Fox Chase Cancer Center in Philadelphia, PA. He was the founding director of the NASA Astrobiology Institute (1999-2002), a virtual research organization that is an element of the Astrobiology Program. Dr. Blumberg won the Nobel Prize in Physiology or Medicine, with D. Carleton Gajdusek, in 1976 for discoveries concerning new mechanisms for the origin and dissemination of infectious disease, which led to blood screening programs for the hepatitis B virus. Upon receiving his award, he told the *New York Times:* "I'm especially pleased that someone from Philadelphia won. It's appropriate in the Bicentennial year and makes up in part for the Phillies not making it to the World Series." Dr. Blumberg has a B.S. degree from Union College in Schenectady, NY (1946), an M.D. from Columbia University's College of Physicians and Surgeons (1951), and a Ph.D. in biochemistry from Oxford University (1957). He worked with the National Institutes of Health from 1957 to 1965, at which time he joined the Fox Chase Cancer Center. At age 64, Dr. Blumberg returned to Oxford as master of Balliol College, becoming the first scientist and first U.S. citizen to hold the position. Dr. Blumberg is the recipient of numerous other awards in addition to the Nobel Prize, including the Eppinger Prize from the University of Freiburg (1973), the Distinguished Achievement Award in Modern Medicine (1975), the Governor's Award in the Sciences from the Commonwealth of Pennsylvania (1988), and the Gold Medal Award from the Canadian Liver Foundation (1990).

Martin Brasier is a Professor of Palaeobiology in the Department of Earth Science at the University of Oxford. Dr. Brasier's research focuses on the following questions: Just how good are patterns in the fossil record for studying the origins of major biological groups? And just how good is our own mental equipment for interpreting those patterns when we discover them? His first tentative answers to these questions emerged after a year spent as Ship's Scientist aboard the HMS *Fawn* during its 1970 Caribbean cruise. From this experience he learned that it is the analysis of *interconnections* between and within systems that may provide a valuable key for decoding the early history of life. Ever since, he has sought to expand understanding of big transitions in the fossil record, pushing ever deeper in geological time. Questions that interest him tend to relate to some very major

interconnections in deep time, such as patterns and processes in the Cambrian explosion; origins of the animal phyla; origins of terrestrial ecosystems; the earliest fossil record; and the origins of life itself. Dr. Brasier's current areas of field activity include the Archaean of Australia and the Proterozoic and Cambrian of Canada, Australia, Asia, and Oman as well as Britain. He and his research group often undertake active comparisons between recent and ancient ecosystems, and they like to pioneer innovative high-resolution biogeochemical mapping techniques, ranging from satellite imaging and field mapping to microscopic mapping using methods such as confocal microscopy. Dr. Brasier is a Fellow of St. Edmund Hall, Oxford, and has served as Chairman of the Faculty of Earth Sciences and the Subcommission on Cambrian Stratigraphy. He also holds a Professorship at Memorial University, Newfoundland. He has served on U.S. National Science Foundation and NASA panels. His first popular science book, *Darwin's Lost World: The Hidden History of Animal Life*, was published in 2009 as a celebration of Darwin's 200th birthday.

Pamela G. Conrad, an astrobiologist with the Planetary Environments Laboratory in the Sciences and Exploration Directorate at NASA's Goddard Space Flight Center, has traveled to the ends of the Earth to study life. Her work focuses on planetary habitability assessment, encompassing the development of approaches to and measurements for habitability assessment in planetary surface environments and the development of noninvasive optical methods for in situ identification of potential rock sample targets. She is interested in the short-range remote sensing of chemical biosignatures and the stability and environmental distribution of such signatures. Dr. Conrad holds a B.A. degree in applied music and an M.A. in composing from George Washington University (GWU). While earning her living as an opera singer, film score composer, and TV producer and director, she maintained an interest in science, ultimately earning a Ph.D. in geology from GWU. She did research in high-pressure mineral physics as a pre-doctoral fellow at the Carnegie Institution's Geophysical Laboratory in Washington, D.C., and later joined the NASA Jet Propulsion Laboratory's Science Division to pursue astrobiology research. She joined the Goddard lab this year. Dr. Conrad is a member of the Arctic Mars Analog Svalbard Expedition (AMASE), funded in part by NASA's Astrobiology Science and Technology for Exploring Planets (ASTEP) program, which does field research north of the Arctic Circle to collect scientific data and planetary exploration technologies. She is also a member of the NASA Astrobiology Institute's Virtual Planetary Laboratory team.

John B. (Jack) Corliss is on the Visiting Faculty in the Department of Environmental Science and Policy at Central European University in Budapest, where he teaches a course on systems dynamics and environmental strategies (see www.collectivedynamics.org). Dr. Corliss has worked in the fields of chemistry, geology, oceanography, and the origins of life. He received his Ph.D. from the Scripps Institution of Oceanography. As part of his doctoral work, he analyzed samples of basaltic rock from the Mid-Atlantic Ridge, finding chemical evidence of hot water circulation, which suggested the existence of undersea hot springs, now known as hydrothermal vents. He joined the faculty at Oregon State University and pursued oceanographic research in geology and geochemistry, ultimately organizing and leading the 1977 expedition aboard the ALVIN research submersible that first discovered deep-sea hydrothermal vents and resident chemosynthetic life in the Galápagos Rift of the Mid-Ocean Ridge. The findings of this expedition led Dr. Corliss to propose that the earliest life on Earth began in deep-sea vents. In 1983 he moved to Budapest and continued to work on his hot-

spring hypothesis for the origin of life. In 1988 he joined the Computer Systems Research Facility at NASA's Goddard Space Flight Center to work on massively parallel processor array algorithms for simulating evolutionary systems. In 1993 he became Director of Research for Biosphere 2 in Arizona, then returned to Budapest in 1996 to start and direct a Complex Adaptive Systems Laboratory for the Environmental Sciences and Policy program at Central European University.

Steven J. Dick served as NASA's chief historian from 2003-2009. He is coauthor, with James E. Strick, of the definitive scholarly history of exobiology and astrobiology, *The Living Universe: NASA and the Development of Astrobiology* (2004). Dr. Dick obtained his B.S. in astrophysics (1971) and his M.A. and Ph.D. (1977) in history and philosophy of Science from Indiana University. He worked as an astronomer and historian of science at the U.S. Naval Observatory in Washington, D.C. for 24 years before coming to NASA Headquarters in 2003. Among his other books are *Sky and Ocean Joined: The U.S. Naval Observatory, 1830-2000* (2003), which received the Pendleton Prize of the Society for History in the Federal Government; *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (1982); *The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science* (1996); and *Life on Other Worlds* (1998). The latter has been translated into Chinese, Italian, Czech, Polish, and Greek. Dr. Dick is editor of *Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications* (2000). He is the recipient of the Navy Meritorious Civilian Service Medal, and he received the NASA Group Achievement Award for his role in NASA's Astrobiology Program. He has served as chairman of the Historical Astronomy Division of the American Astronomical Society, president of the History of Astronomy Commission of the International Astronomical Union, and president of the Philosophical Society of Washington. He is a member of the International Academy of Astronautics. Minor planet 6544 Stevendick is named in his honor.

Daniel P. Glavin is an astrobiologist at NASA's Goddard Space Flight Center, with a research emphasis in organic chemistry and meteorite analysis. He is associate chief of the Planetary Environments Laboratory at Goddard. He joined NASA in 2004. Dr. Glavin holds a B.S. degree in physics (1996) from the University of California-San Diego (UCSD) and a Ph.D. in Earth sciences (2001) from UCSD's Scripps Institution of Oceanography. In 1998, he was awarded a NASA Specialized Center for Research and Training (NSCORT) Fellowship for research in Dr. Jeff Bada's laboratory at the Scripps Institution of Oceanography. For his doctoral thesis he investigated sublimation from meteorite grains as a potential survival mechanism for amino acids in micrometeorites and interplanetary dust particles during atmospheric entry. He also developed extraction protocols for the analysis of extraterrestrial amino acids in carbonaceous chondrites, Antarctic micrometeorites, lunar and martian meteorites using high-performance liquid chromatography. Working with the NASA Jet Propulsion Laboratory, he helped develop a laboratory prototype for the Mars Organic Detector (MOD) instrument that was selected for the 2003 NASA Mars Sample Return mission (cancelled in 1999). He has worked on development of the Sample Analysis at Mars (SAM) gas chromatograph/mass spectrometer instrument that will fly on NASA's Mars Science Laboratory (MSL) mission. He is a Principal Investigator with the Exobiology and Evolutionary Biology program ("Investigating the Distribution and Nitrogen Isotopic Composition of Nucleobases in Carbonaceous Meteorites") and the Astrobiology Science and Technology Instrument

Development (ASTID) program ("VAPoR: A Miniature Pyrolysis Time-of-Flight Mass Spectrometer Prototype for In Situ Investigations in Planetary Astrobiology"). He is also a Co-Investigator on the NASA Astrobiology Institute's Goddard Center for Astrobiology team.

Daniel S. Goldin is the Founder, Chairman and CEO of The Intellisis Corporation, which develops neurobiologically inspired computational engines. Previously, as NASA's longest serving Administrator from 1992-2001, he directly served three U.S. Presidents: George H.W. Bush, William Jefferson Clinton, and George W. Bush. Prior to NASA, he was the Vice President and General Manager of TRW Space and Technology Group where he oversaw a broad range of technology developments and programs for both government and industry. He began his career at NASA's Glenn Research Center working on electric propulsion systems for interplanetary travel. Mr. Goldin serves on the Board of Directors of AOptix Technologies and the Board of Trustees of the National Geographic Society. He is a Member of the National Academy of Engineering, National Institutes of Health Scientific Management Review Board, Science and Technology in Society forum, International Academy of Astronautics and Scripps Institute of Oceanography Advisory Council. He is a Distinguished Fellow at the Council on Competitiveness and a Fellow of the American Institute for Aeronautics and Astronautics and the American Astronautical Society. He graduated from the City College of New York in 1962 with a Bachelor of Science degree in Mechanical Engineering.

James L. Green is Director for Planetary Science in NASA's Science Mission Directorate. He received his Ph.D. in Space Physics from the University of Iowa in 1979 and began working in the Magnetospheric Physics Branch at NASA's Marshall Space Flight Center (MSFC) in 1980. At Marshall, Dr. Green developed and managed the Space Physics Analysis Network that provided scientists all over the world with rapid access to data, to other scientists, and to specific NASA computer and information resources. In addition, Dr. Green was a Safety Diver in the Neutral Buoyancy tank making over 150 dives until leaving MSFC in 1985. From 1985 to 1992 he was the head of the National Space Science Data Center (NSSDC) at Goddard Space Flight Center (GSFC). The NSSDC is NASA's largest space science data archive. In 1992, he became the Chief of the Space Science Data Operations Office until 2005, when he became the Chief of the Science Proposal Support Office. While at GSFC, Dr. Green was a co-investigator and the Deputy Project Scientist on the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) mission. He has written over 100 scientific articles in refereed journals involving various aspects of the Earth's and Jupiter's magnetospheres and over 50 technical articles on various aspects of data systems and networks. In August 2006, Dr. Green became the Director of the Planetary Science Division at NASA Headquarters. Over his career, Dr. Green has received numerous awards. In 1988, he received the Arthur S. Flemming award given for outstanding individual performance in the federal government and was awarded Japan's Kotani Prize in 1996 in recognition of his international science data management activities.

David Grinspoon is Curator of Astrobiology at the Denver Museum of Nature and Science and adjunct professor of Astrophysical and Planetary Sciences at the University of Colorado. He previously served as a principal scientist in the Department of Space Studies at the Southwest Research Institute. Dr. Grinspoon holds a Sc.B. degree in planetary science (1982) and a B.A. in philosophy of science (1982) from Brown University and a Ph.D. from the University of

Arizona (1989), where he earned a Gerard Kuiper Memorial Award for outstanding scholarship. He was a postdoctoral research associate at NASA's Ames Research Center, Mountain View, CA (1989-1991). He has been a Principal Investigator with the Exobiology and Evolutionary Biology program ("The Longevity of Oceans on Terrestrial Planets"). He is a member of the NASA Astrobiology Institute's Jet Propulsion Laboratory/Titan team, and he coauthored a white paper on "Astrobiology Research Priorities for Mercury, Venus, and the Moon" for the Space Studies Board's 2009 – 2011 Planetary Science Decadal Survey. Dr. Grinspoon's book *Venus Revealed: A New Look below the Clouds of Our Mysterious Twin Planet* (1997) won a *Los Angeles Times* Book Prize (1998), and his book *Lonely Planets: The Natural Philosophy of Alien Life* (2003) won the PEN Center USA's 2004 Literary Award for Research Nonfiction. His writing has appeared in *Astronomy*, *Natural History*, *Nature*, *Science*, *Scientific American*, *Slate*, and *The Sciences*. Dr. Grinspoon received the American Astronomical Society's 2006 Carl Sagan Medal for Excellence in Public Communication in Planetary Science. He is a contributing editor and monthly columnist ("Cosmic Relief") for *Sky & Telescope* magazine. He maintains the Funky Science Web site at www.funkyscience.net.

Noel W. Hinners consults for NASA, the aerospace industry, and 4-D Systems, which supports the NASA Academy of Program and Project Leadership. Dr. Hinners retired in January 2002 from Lockheed Martin Astronautics, Denver, where he was vice president of Flight Systems with primary responsibility for their NASA missions. He joined Martin Marietta Corporation as vice president of strategic planning in 1989. Dr. Hinners served as NASA associate deputy administrator and chief scientist (1987 to 1989), director of the NASA Goddard Space Flight Center (1982 to 1987), director of the Smithsonian's National Air and Space Museum (1979 to 1982), and NASA's associate administrator for Space Science (1974 to 1979) and director of Lunar Programs (1972 to 1974). Before entering government service, Dr. Hinners was department head of Lunar Exploration with Bellcomm, Inc., which he joined as a member of the technical staff in 1963. At Bellcomm, he was responsible for Apollo lunar science formulation and Apollo site selection support to NASA. Dr. Hinners was the founding Editor of *Geophysical Research Letters*, a rapid-publication journal of the American Geophysical Union, and founding President of the Maryland and Colorado Space Business Round Tables. Noel has been on and chaired oodles of space-related committees and has published on NASA programs. He currently serves on the Executive Committee of NASA's Mars Exploration Program Analysis Group, co-chairs the Joint (NASA/ESA) Mars Architecture Review Team, and is Executive Secretary of the NASA Chief Engineer's Management Operations Working Group. He serves on the External Advisory Board of the University of Colorado Aerospace Engineering Sciences Department.

Marc Kaufman is a science writer and editor at The Washington Post, though he says that, at heart, he sees himself as a foreign correspondent. His book on astrobiology, *First Contact: Scientific Breakthroughs in the Hunt for Life Beyond Earth*, will be published in April. Publisher Simon & Schuster describes it as "the incredible true story of science's search for the beginnings of life on Earth and the probability that it exists elsewhere in our universe." Before joining The Post in 1999, Mr. Kaufman was a reporter at the *Philadelphia Inquirer* for 17 years. He did a tour in India for the *Inquirer*, spent a lot of time in Afghanistan in the late 1980s and through the 1990s, and returned to Afghanistan for The Post after 9/11. Given his foreign-correspondent instincts, Mr. Kaufman managed to turn his *First Contact* reporting into

a global affair, making trips to Alabama, Alaska, Australia, Chile, Death Valley (CA), England, Florida, Idaho, Italy, Japan, Louisiana, and South Africa, among other places. Over the past six months, he has reported for the Post on topics ranging from the BP oil spill to the search for organics on Mars, plans for space tourism, and the Kepler mission's extrasolar planet discoveries. Mr. Kaufman's wife, Lynn Litterine, is an editor, writer and educator, their son David is an attorney and son John is studying to be a veterinarian.

Alan Ladwig is currently a political appointee of the Obama Administration serving in the Office of Communications as Deputy Associate Administrator for Public Outreach at NASA Headquarters. He served on the NASA Review Team for the Obama transition and upon his return to the Agency served as a Senior Advisor to the Administrator. Prior to returning to NASA Mr. Ladwig was the Manager of Space Systems for Whitney, Bradley and Brown, Inc. (WBB Consulting) and had been Sector Lead Executive for NASA business development at Northrop Grumman Integrated Systems. He served as Chief Operating Officer during the start-up phase of the Zero Gravity Corporation, a privately held space tourism and entertainment company. As Vice President of Washington Operations and Assistant to the Chairman of the Board, he established and managed the Space.com's Washington Bureau and was responsible for business development, NASA relations, and strategic planning. Mr. Ladwig completed two previous tours at NASA. As a political appointee of the Clinton Administration from 1993 to 1994, he was the Associate Administrator of the Office of Policy and Plans at NASA Headquarters. From 1981 to 1989, he was a civil servant at NASA Headquarters and managed a variety of programs for the Office of Education, the Office of Space Flight and the Office of Exploration. NASA awarded Mr. Ladwig the Distinguished Service Medal, the Exceptional Achievement Medal, and two Exceptional Service Medals. He is a Fellow of the American Astronautical Society.

Roger D. Launius is a Senior Curator in the Division of Space History at the Smithsonian Institution's National Air and Space Museum in Washington, D.C., where he was division chair from 2003-2007. From 1990 to 2002, he served as chief historian of NASA. A graduate of Graceland College in Lamoni, Iowa, he received his Ph.D. from Louisiana State University (1982). He has written or edited more than 20 books on aerospace history, including *Robots in Space: Technology, Evolution, and Interplanetary Travel* (2008); *Societal Impact of Spaceflight* (NASA SP-2007-4801, 2007); *Critical Issues in the History of Spaceflight* (NASA SP-2006-4702, 2006); *Space Stations: Base Camps to the Stars* (2003), which received the American Institute of Aeronautics and Astronautics' history manuscript prize; *To Reach the High Frontier: A History of U.S. Launch Vehicles* (2002); *Imagining Space: Achievements, Possibilities, Projections, 1950-2050* (2001); *Reconsidering Sputnik: Forty Years Since the Soviet Satellite* (2000); *Frontiers of Space Exploration* (1998, rev. 2004); *Spaceflight and the Myth of Presidential Leadership* (1997); and *NASA: A History of the U.S. Civil Space Program* (1994, rev. 2001). He is a Fellow of the American Association for the Advancement of Science, the International Academy of Astronautics, and the American Astronautical Society. Dr. Launius served as a consultant to the *Columbia* Accident Investigation Board in 2003 and presented the prestigious Harmon Memorial Lecture on the history of national security space policy at the United States Air Force Academy in 2006. He has also written about baseball's "super showman" Charlie Finley, Missouri political figure Alexander William Doniphan, and Mormon prophet Joseph Smith.

James E. Lovelock was born on 26 July 1919 in Letchworth Garden City in the United Kingdom. He graduated as a chemist from Manchester University in 1941 and in 1948 received a Ph.D. degree in medicine from the London School of Hygiene and Tropical Medicine. In 1959 he received the D.Sc. degree in biophysics from London University. After graduating from Manchester he started employment with the Medical Research Council at the National Institute for Medical Research in London. In l954 he was awarded the Rockefeller Travelling Fellowship in Medicine and chose to spend it at Harvard Medical School. In 1958 he visited Yale University for a similar period. In 1961 he became a visiting Professor at the University of Houston and a Professor of Chemistry at Baylor University College of Medicine in Houston, Texas, where he remained until 1964. During his stay in Texas he collaborated with colleagues at the Jet Propulsion Laboratory on lunar and planetary research. He was awarded three NASA certificates of recognition in 1972. Since 1964 he has conducted an independent practice in science, while continuing honorary academic associations as a visiting professor. Since 1994 he has been an Honorary Visiting Fellow of Green College (now Green Templeton College, University of Oxford). Dr. Lovelock is the originator of the Gaia Hypothesis (now Gaia Theory) and has written five books on the subject. He is the author of more than 200 scientific papers, and he has applied for more than 40 patents, mostly for detectors for use in chemical analysis. He was elected a fellow of the Royal Society in 1974 and a Fellow of the American Association for the Advancement of Science in 2008. He was made a Commander of the Order of the British Empire in 1990 and in 2003 a Companion of Honour by Her Majesty the Queen.

Lynn Margulis is Distinguished University Professor in the Department of Geosciences at the University of Massachusetts-Amherst. Dr. Margulis earned her degrees from the University of Chicago (B.A., 1957), University of Wisconsin (M.S., zoology, 1960), and University of California-Berkeley (Ph.D., genetics, 1965). Her area of expertise is organellar heredity related to microbial evolution. Dr. Margulis is best known for her theory of symbiogenesis, which challenges a central tenet of neodarwinism: she claims evolutionary novelty (including new species) do not arise by gradual accumulation of random mutations. She is acknowledged for her contribution to James E. Lovelock's Gaia theory. Dr. Margulis was one of NASA's first female Principal Investigators in Exobiology, receiving support for cell biology laboratory work and microbial ecology field studies related to the Gaia hypothesis. At present she works on the origin and evolution of nuclei, undulipodia, and other cytoskeletal structures from archaebacterial associations with sulfide-oxidizing spirochetes. She is currently an Astrobiology Principal Investigator as co-director, with Dr. Michael Dolan, of the Planetary Biology Internship (PBI) Program. Dolan's dedication to matching graduate students with appropriate NASA "sponsors" continues a tradition maintained since the *PBI* began in 1980 at Boston University. (Dr. Margulis worked at BU for 22 years.) She has authored and edited publications that span a wide range of scientific topics. Among her recent books are *Symbiosis in Cell Evolution: Microbial Communities in the Archean and Proterozoic Eons* (2nd ed., 1993), *Symbiotic Planet: A New Look at Evolution* (1998), and *Mind, Life and Universe: Conversations with Great Scientists of Our Time* (ed. with E. Punset, 2009). With Dorion Sagan she has written *Microcosmos: Four Billion Years of Evolution from Our Microbial Ancestors* (1986); *Acquiring Genomes: A Theory of the Origins of Species (2002)*; and other books. Her work with Dr. Michael J. Chapman provides a consistent formal classification of life on Earth. It led to the fourth edition of *Five Kingdoms,* now *Kingdoms & Domains: An Illustrated Guide to the Phyla of Life on Earth* (2010). She participates with colleagues in making films and

hands-on teaching activities for middle school to post-doctoral students and teachers. She was elected to the U.S National Academy of Sciences in 1983 and received the Presidential Medal of Science in 1999.

Victoria Meadows is an astrobiologist and planetary astronomer whose research interests focus on acquisition and analysis of remote-sensing observations of planetary atmospheres and surfaces. Dr. Meadows holds a Ph.D. from the University of Sydney (1994). She spent the majority of her career at NASA's Jet Propulsion Laboratory and joined the Astronomy Department at the University of Washington, where she is an Associate Professor, in 2007. In addition to studying planets within our own Solar System, Dr. Meadows is interested in extrasolar planets, planetary habitability, and biosignatures. Since 2001, she has been the Principal Investigator for the NASA Astrobiology Institute's (NAI's) Virtual Planetary Laboratory team. Her team uses models of planets, including planet-star interactions, to generate plausible planetary environments and spectra for extrasolar terrestrial planets and the early Earth. This research is being used to help define signs of habitability and life for future extrasolar terrestrial planet detection and characterization missions. Dr. Meadows was a Co-Investigator on NASA's EPOXI (extrasolar planet observation and characterization/Deep Impact extended investigation) mission, working on observations of the distant Earth. Among numerous publications she has coauthored are "The Time-Dependent Effect of a Stellar Flare on Terrestrial Planet Habitability and Biosignatures" (*Astrobiology*, 2010), "Detecting Oceans on Extrasolar Planets Using the Glint Effect" (*Astrophysical Journal*, 2010), and "Planetary Environmental Signatures for Habitability and Life" (*Exoplanets*, Ed. John Mason, 2008), and "A Decreased Probability of Habitable Planet Formation around Low-Mass Stars" (*The Astrophysical Journal*, 2007).

Michael A. Meyer is a Senior Scientist in the Planetary Science Division in NASA's Science Mission Directorate at NASA Headquarters. He is Lead Scientist for the Mars Exploration Program, responsible for the science content of current and future Mars missions, and Program Scientist for the Mars Science Laboratory mission (to be launched in 2011) and for the 2018 NASA/ESA Mars mission. Dr. Meyer was Senior Scientist for Astrobiology, Program Scientist for the 2001Mars Odyssey mission and Discipline Scientist for Astrobiology when the Astrobiology Program was established in 1997. He also managed the Exobiology Program and, from 1994 to 1997, served as Planetary Protection Officer for NASA. Dr. Meyer originally was detailed to NASA from the Desert Research Institute, University of Nevada, where he was an assistant research professor from 1989-97. From 1985 to 1989, he served as associate director and associate in research for the Polar Desert Research Center, Department of Biological Science, and Florida State University. In 1982, he was a visiting research scientist at the Culture Centre for Algae and Protozoa in Cambridge, England. Dr. Meyer's research interest is in microorganisms living in extreme environments, particularly the physical factors controlling microbial growth and survival. He has conducted field research in the Gobi Desert, Negev Desert, Siberia, and the Canadian Arctic. He is also a veteran of six research expeditions to Antarctica. His experience includes two summers working as a treasure salvager off the coasts of Florida and North Carolina. Dr. Meyer earned his Ph.D. and M.S. in oceanography from Texas A&M University (1985, 1981) and his B.S. in biology from Rensselaer Polytechnic Institute (1974).

R. Stephen Price is the Director of Business Development for Sensing & Exploration Systems and the Advanced Technology Center at Lockheed Martin Space System Company. Mr. Price holds a Bachelor's degree in aerospace engineering from the University of Colorado and a Master of Science degree in aerospace engineering, also from the University of Colorado. He is the recipient of numerous awards including four technical achievement awards from Lockheed Martin and two NASA Public Service Awards for work on Stardust and Genesis. Mr. Price is responsible for all aspects of the Space Systems Company's new business pursuits that focus on environmental and meteorology satellites, planetary exploration, astrophysics, heliophysics and active/passive remote sensing for Government and foreign agencies. He also guides the strategic and investment planning of Space Systems Company advanced technology developments and deployments. Over the last 32 years in the aerospace industry, Mr. Price has worked on NASA missions as well as classified and military systems. The majority of his career has been devoted to space science and exploration including lead roles on Stardust, Mars programs and technology development projects.

Lynn J. Rothschild is an evolutionary biologist/astrobiologist at NASA's Ames Research Center and Professor at Stanford and Brown University, where she teaches Astrobiology and Space Exploration. She holds degrees in biology from Yale and Indiana universities and a Ph.D. from Brown University. Since arriving at Ames in 1987, her research has focused on how life, particularly microbes, has evolved in the context of the physical environment, on Earth and potentially elsewhere. She has co-edited a book on the subject entitled, *Evolution on Planet Earth: The Impact of the Physical Environment* (2003). Dr. Rothschild has studied carbon metabolism and DNA damage and repair in the laboratory and on algae, work that has taken her to field sites in such locations as Australia, Baja California, the Bolivian Andes, Kenya's Rift Valley, and New Zealand. Her lab group studies topics ranging from radiation-resistant invertebrates to resistance mechanisms in halophiles and algae to synthetic biology. Most recently she has taken to the air, flying experiments up to 106,000 feet on high-altitude balloons, in conjunction with Stanford's Aeronautics and Astronautics Department and the Mavericks Civilian Rocket Foundation. Dr. Rothschild founded and ran the first three Astrobiology Science Conferences (AbSciCons) and was founding co-editor of the International Journal of Astrobiology. She lectures frequently worldwide. She has been a member of the NASA Astrobiology Institute since its inception. Like Darwin, she is a Fellow of the Linnean Society of London. She is also a Fellow of the California Academy of Sciences and the Explorers Club.

Steve Squyres is Goldwin Smith Professor of Astronomy at Cornell University. Dr. Squyres earned a Ph.D. in planetary science from Cornell (1981). His research focuses on the robotic exploration of planetary surfaces, the history of water on Mars, the geophysics and tectonics of icy satellites, the tectonics of Venus, and planetary gamma-ray and x-ray spectroscopy. Research for which he is best known includes the study of the history and distribution of water on Mars and of the possible existence and habitability of a liquid water ocean on Europa. Dr. Squyres has participated in a number of planetary exploration missions. From 1978 to 1981 he was an associate of the *Voyager* imaging science team, participating in analysis of imaging data from the spacecraft's encounters with Jupiter and Saturn. He was a radar investigator on the *Magellan* mission to Venus, a member of the *Mars Observer* gamma-ray spectrometer flight investigation team, and a Co-Investigator on the Russian Mars `96

mission. Dr. Squyres is currently scientific Principal Investigator for the Mars Exploration Rover Project. He is also a Co-Investigator on the *Mars Express* mission and on the *Mars Reconnaissance Orbiter*'s High Resolution Imaging Science Experiment. He is a member of the Gamma-Ray Spectrometer Flight Investigation Team for the *Mars Odyssey* mission and the imaging team for the *Cassini* mission to Saturn. He is also working on instruments for NASA's Mars Science Laboratory to be launched in 2011. Dr. Squyres co-chairs the Space Studies Board 2009-2011 Decadal Survey of Planetary Exploration.

Mary Voytek is in charge of NASA's Astrobiology Program in NASA's Planetary Science Division in the Science Mission Directorate at NASA Headquarters. Dr. Voytek also serves as the Deputy Program Scientist for the Mars Science Laboratory mission (to be launched in November 2011). She has degrees in Biochemistry from Johns Hopkins University, Biological Oceanography from the University of Rhode Island and Biology and Ocean Sciences from the University of California Santa Cruz. Before coming to NASA, she led the Microbiology and Molecular Ecology team at the U.S. Geological Survey in Reston, VA. Dr. Voytek's primary research interests are microbial ecology and biogeochemistry and include understanding the environmental controls on microbial transformations of nutrients, xenobiotics, and metals in freshwater and marine systems. Her research has taken her to several extreme environments including Antarctica, the Arctic, hypersaline lakes, deep-sea hydrothermal vents, and terrestrial deep- subsurface sites. She has conducted deep-biosphere studies at the Chesapeake Bay Impact Structure. The most recent results of this research project were published in the June 27, 2008, issue of Science. While at the USGS, she served on the NASA Advisory Council's Planetary Protection Subcommittee and also on several NASA and COSPAR advisory groups on special topics. She also served as a technical advisor to the US State Department mission to Pakistan, providing scientific advice on developing safe drinking water practices while protecting water resources. She has been active in the leadership of the AGU Biogeosciences Section for the last 10 years and was recently elected to the AGU Board of Directors.